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(54) **MIDDLEWARE FILTER AGENT BETWEEN SERVER AND PDA**

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H04L 29/06	(2006.01)
H04L 29/08	(2006.01)

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CPC ***H04L 63/0245*** (2013.01); ***H04L 29/06*** (2013.01); ***H04L 67/1095*** (2013.01); ***H04L 67/2804*** (2013.01); ***H04L 67/2842*** (2013.01); ***H04L 67/2871*** (2013.01); ***H04L 67/2895*** (2013.01); ***H04L 69/329*** (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,577,232	A	11/1996	Priem et al.
5,710,908	A	1/1998	Man
5,732,275	A	3/1998	Kullick et al.
5,761,655	A	6/1998	Hoffman

(Continued)

OTHER PUBLICATIONS

SyncML, "SyncML Sync Protocol, version 1.01", htt:/www.syncml.org/docs/syncml prptpcol v 101 20010615.pdf, Version 1.0.1, pp. 1-61, Jun. 15, 2001.

Michael Ehrmantraut et al., "The Personal Electronic Program Guide Towards the Pre-Selection of Individual TV Prgrams", 1996 ACM 0-89791-873-8/96/11, pp. 243-250.

Awbrey, Alicia; Spektor, Reena, "Apple Unveils New iPods,"5GB, 10GB and 20GB Versions for Mae & Windows, http://www.apple.com/pr/library/2002/jul/17ipod.html, Jul. 17, 2002, p. 1-3, Macworld Expo, New York.

(Continued)

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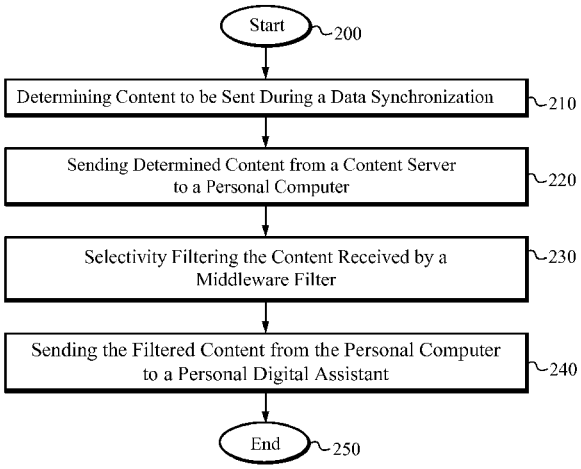
(57) **ABSTRACT**

A content server provides content to a first network device during a data synchronization between the two devices. A middleware filter selectively filters content provided by the content server such that selected content is provided to the first network device. The middleware filter is included within a second network device coupled between the content server and the first network device. The second network device acts as a proxy for the first network device to receive the content provided by the content server. The content is provided from the content server according to a subscription service between the content server and the first network device. The first network device is preferably a personal digital assistant (PDA) and the second network device is preferably a personal computer. Alternatively, the content server is coupled to the first network device, without the second network device coupled in between. In the alternative case, the middleware filter is included within the content server, and the content is selectively provided from the middleware filter, on the content server, to the first network device.

21 Claims, 5 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

5,764,992	A	6/1998	Kullick et al.	
5,835,911	A	11/1998	Nakagawa et al.	
5,848,064	A	12/1998	Cowan	
5,951,639	A	9/1999	MacInnis	
5,970,501	A	10/1999	Hunkins et al.	
6,009,274	A	12/1999	Fletcher et al.	
6,031,830	A	2/2000	Cowan	
6,119,165	A	9/2000	Li et al.	
6,189,046	B1	2/2001	Moore et al.	
6,212,529	B1 *	4/2001	Boothby et al.	
6,219,698	B1	4/2001	Iannucci et al.	
6,226,744	B1	5/2001	Murphy et al.	
6,233,252	B1	5/2001	Barker et al.	
6,253,207	B1	6/2001	Malek et al.	
6,272,547	B1	8/2001	McWilliams	
6,275,529	B1	8/2001	Sato	
6,308,061	B1	10/2001	Criss et al.	
6,341,316	B1	1/2002	Kloba et al.	
6,377,640	B2	4/2002	Trans	
6,381,601	B1	4/2002	Fujiwara et al.	
6,487,605	B1	11/2002	Leung	
6,493,748	B1	12/2002	Nakayama et al.	
6,542,925	B2	4/2003	Brown et al.	
6,564,263	B1	5/2003	Bergman et al.	
6,567,980	B1	5/2003	Jain et al.	
6,594,228	B1	7/2003	Naidoo et al.	
6,614,807	B1	9/2003	Mikkila	
6,615,248	B1	9/2003	Smith	
6,643,506	B1	11/2003	Criss et al.	
6,643,684	B1	11/2003	Malkin et al.	
6,687,878	B1	2/2004	Eintracht et al.	
6,708,217	B1	3/2004	Colson et al.	
6,735,434	B2	5/2004	Criss et al.	
6,747,991	B1 *	6/2004	Hemy et al.	370/468
6,754,717	B1	6/2004	Day, III et al.	
6,801,604	B2	10/2004	Maes et al.	
6,871,236	B2	3/2005	Fishman et al.	
6,877,134	B1	4/2005	Fuller et al.	
6,892,230	B1	5/2005	Gu et al.	
6,920,468	B1	7/2005	Cousins et al.	
6,944,185	B2	9/2005	Patki et al.	
6,968,184	B2	11/2005	Criss et al.	
6,976,053	B1	12/2005	Tripp et al.	
6,981,138	B2	12/2005	Douceur et al.	
6,990,498	B2	1/2006	Fenton et al.	
7,016,966	B1	3/2006	Saulpaugh et al.	
7,024,430	B1 *	4/2006	Ingraham et al.	
7,024,491	B1 *	4/2006	Hanmann et al.	709/248
7,028,306	B2	4/2006	Boloker et al.	
7,035,879	B2	4/2006	Shi et al.	
7,043,477	B2	5/2006	Mercer et al.	
7,062,515	B1	6/2006	Thomas et al.	
7,062,546	B1	6/2006	Kolar et al.	
7,076,555	B1	7/2006	Orman et al.	
7,117,253	B2	10/2006	Nakayama et al.	
7,117,482	B2	10/2006	Nguyen et al.	
7,136,934	B2	11/2006	Carter et al.	
7,149,813	B2	12/2006	Flanagin et al.	
7,185,070	B2	2/2007	Paul et al.	
7,197,049	B2	3/2007	Engstrom et al.	
7,206,831	B1	4/2007	Dube et al.	
7,294,056	B2	11/2007	Lowell et al.	
7,376,386	B2	5/2008	Phillips et al.	
7,404,011	B2	7/2008	Hansmann et al.	
7,404,142	B1	7/2008	Tischer	
7,418,482	B1	8/2008	Lusher et al.	
7,432,940	B2	10/2008	Brook et al.	
7,478,047	B2	1/2009	Loyall et al.	
7,668,738	B2	2/2010	Wiggins	
7,925,790	B2 *	4/2011	Xue et al.	709/248
8,359,406	B2 *	1/2013	Xue et al.	709/248
2001/0021994	A1	9/2001	Nash	
2001/0029178	A1	10/2001	Criss et al.	
2001/0034771	A1	10/2001	Hutsch et al.	
2001/0042073	A1	11/2001	Saether et al.	
2002/0013852	A1	1/2002	Janik	
2002/0022453	A1	2/2002	Balog et al.	
2002/0038319	A1	3/2002	Yahagi	
2002/0046278	A1	4/2002	Hays et al.	
2002/0059583	A1	5/2002	Kim	
2002/0059624	A1	5/2002	Machida et al.	
2002/0073172	A1	6/2002	Armstrong et al.	
2002/0080169	A1	6/2002	Diedriks	
2002/0091802	A1	7/2002	Paul et al.	
2002/0095399	A1	7/2002	Devine et al.	
2002/0112058	A1	8/2002	Weiseman et al.	
2002/0120885	A1	8/2002	Choi et al.	
2002/0143819	A1	10/2002	Han et al.	
2002/0161934	A1	10/2002	Johnson et al.	
2002/0174180	A1	11/2002	Brown et al.	
2002/0194209	A1	12/2002	Bolosky et al.	
2002/0194309	A1	12/2002	Carter et al.	
2002/0194388	A1	12/2002	Boloker et al.	
2002/0198962	A1	12/2002	Horn et al.	
2003/0004947	A1	1/2003	Coverston	
2003/0014483	A1	1/2003	Stevenson et al.	
2003/0028896	A1	2/2003	Swart et al.	
2003/0041147	A1	2/2003	Van Den Oord et al.	
2003/0093488	A1	5/2003	Yoshida et al.	
2003/0105778	A1	6/2003	Andani	
2003/0120685	A1	6/2003	Duncombe et al.	
2003/0140068	A1	7/2003	Yeung	
2003/0140088	A1	7/2003	Robinson et al.	
2003/0163467	A1	8/2003	Cazier	
2003/0167318	A1	9/2003	Robbin et al.	
2003/0182419	A1	9/2003	Barr et al.	
2003/0182436	A1	9/2003	Henry	
2003/0182450	A1	9/2003	Ong et al.	
2003/0212608	A1	11/2003	Cliff	
2003/0217181	A1	11/2003	Kiiskinen	
2003/0220966	A1	11/2003	Hepper et al.	
2003/0231741	A1	12/2003	Rancu et al.	
2004/0010467	A1	1/2004	Hori et al.	
2004/0039834	A1	2/2004	Saunders et al.	
2004/0073787	A1	4/2004	Ban et al.	
2004/0073901	A1	4/2004	Imamatsu	
2004/0078470	A1	4/2004	Baumeister et al.	
2004/0088731	A1	5/2004	Putterman et al.	
2004/0098379	A1	5/2004	Huang	
2004/0103064	A1	5/2004	Howard et al.	
2004/0128327	A1	7/2004	Shi et al.	
2004/0167960	A1	8/2004	Kinner et al.	
2004/0181790	A1	9/2004	Herrick	
2004/0194279	A1	10/2004	Roy	
2004/0205263	A1	10/2004	Sivaraman et al.	
2005/0044250	A1	2/2005	Gay et al.	
2005/0055686	A1	3/2005	Buban et al.	
2005/0055687	A1	3/2005	Mayer	
2005/0066063	A1	3/2005	Grigorovitch et al.	
2005/0108754	A1	5/2005	Carhart et al.	
2005/0228812	A1	10/2005	Hansmann et al.	
2005/0267948	A1	12/2005	McKinley et al.	
2005/0283797	A1	12/2005	Eldering et al.	
2006/0002340	A1	1/2006	Criss et al.	
2006/0155400	A1	7/2006	Loomis	
2007/0011670	A1	1/2007	Nguyen et al.	
2007/0177571	A1	8/2007	Caulfield et al.	
2008/0102844	A1	5/2008	Zhu et al.	
2009/0089681	A1	4/2009	Gottipati et al.	

OTHER PUBLICATIONS

Howard P Katseff et al. "Predictive Prefetch in the Nemesis Multimedia Information Service", AT&T Bell Laboratories, pp. 201-209, 1994 ACM.

Michael Ehrmantraut, Theo Harder, Hartmut Wittig, Ralf Steinmetz, "The Personal Electronic Program Guide—Towards the Pre-selection of Individual TV Programs", 1996 ACM 0-89791-873-8/96/11, pp. 243-250, CIKM 96, Rockville MD USA.

* cited by examiner

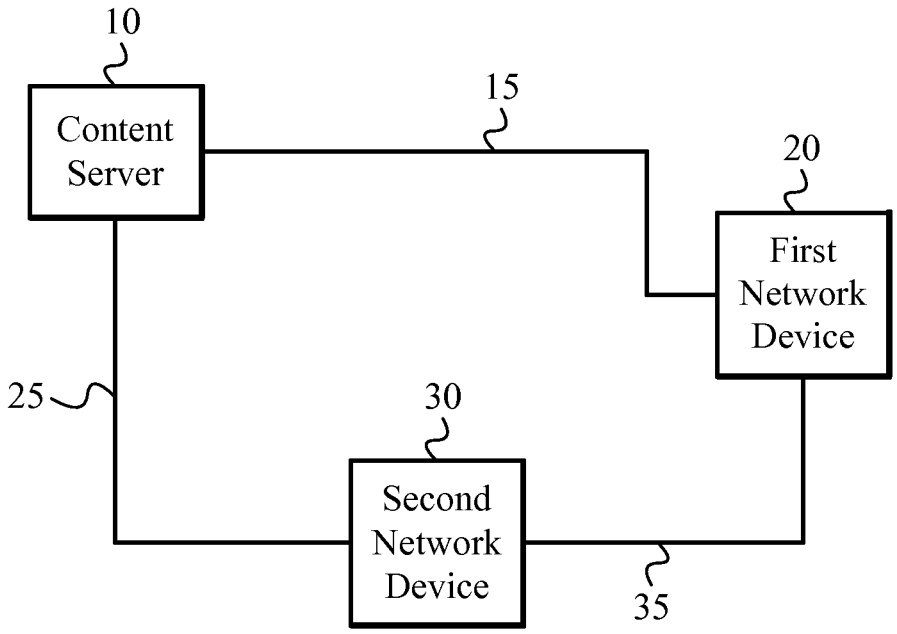
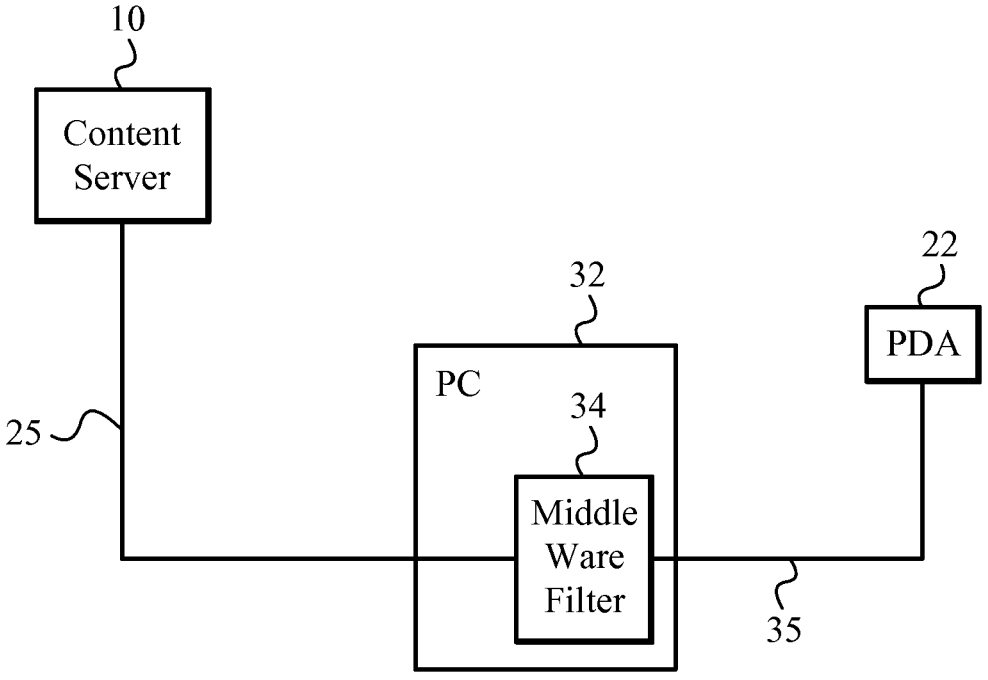

10
Content Server
15
20
First Network Device
25
30
Second Network Device
35

Fig. 1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Content Server
22
32
PDA
PC
34
25
Middle Ware Filter
35

Fig. 2

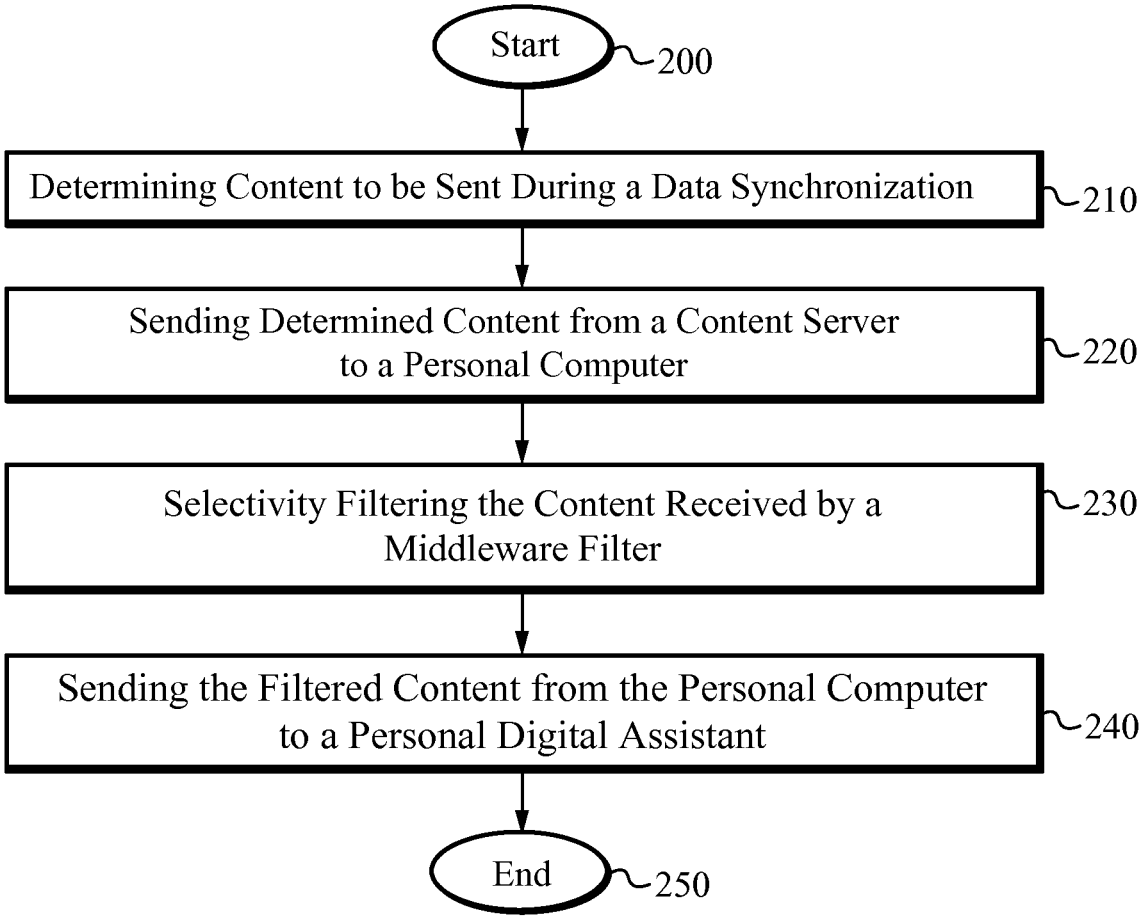

Start
200
Determining Content to be Sent During a Data Synchronization
210
Sending Determined Content from a Content Server to a Personal Computer
220
Selectivity Filtering the Content Received by a Middleware Filter
230
Sending the Filtered Content from the Personal Computer to a Personal Digital Assistant
240
End
250

Fig. 3

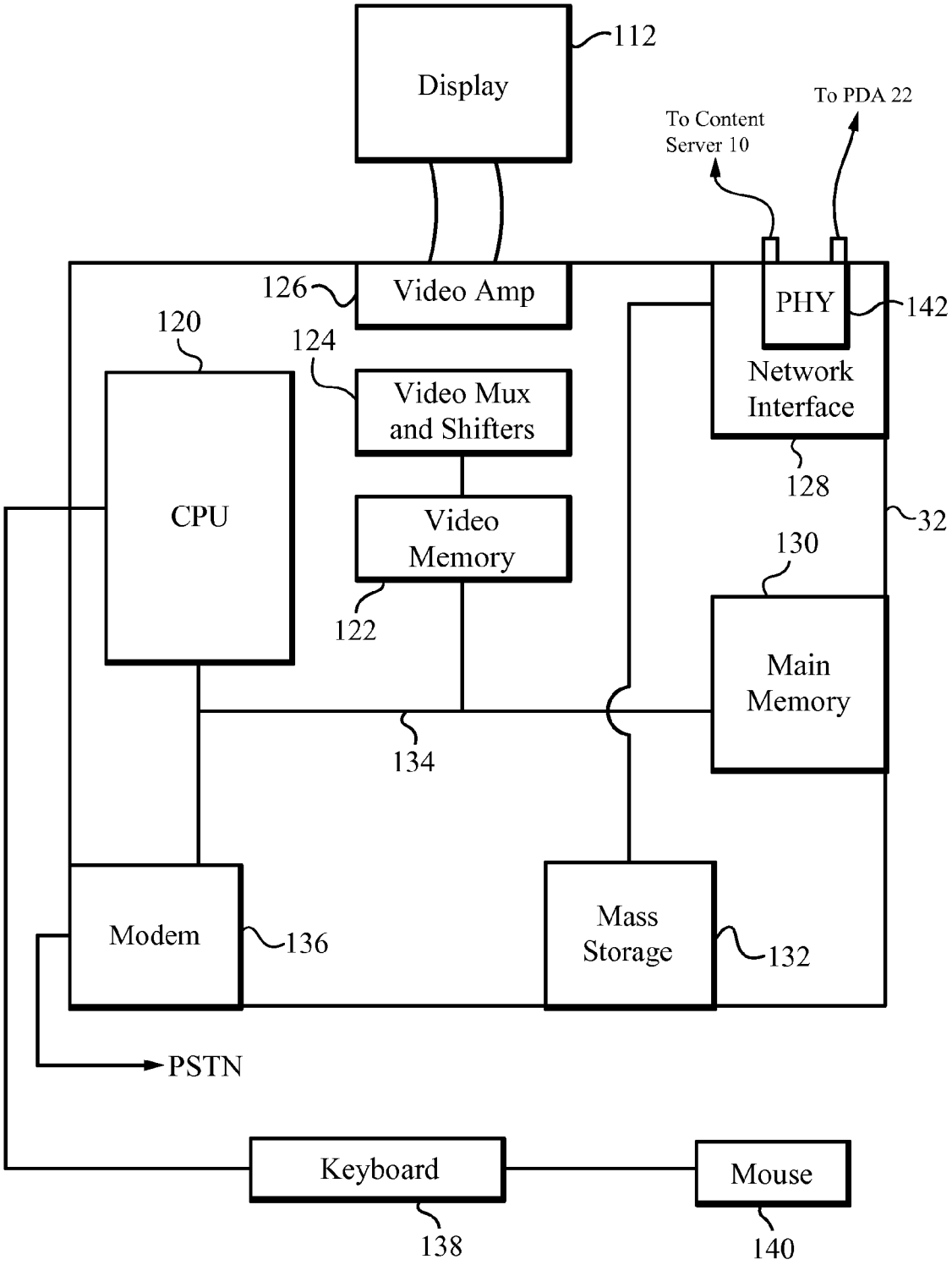
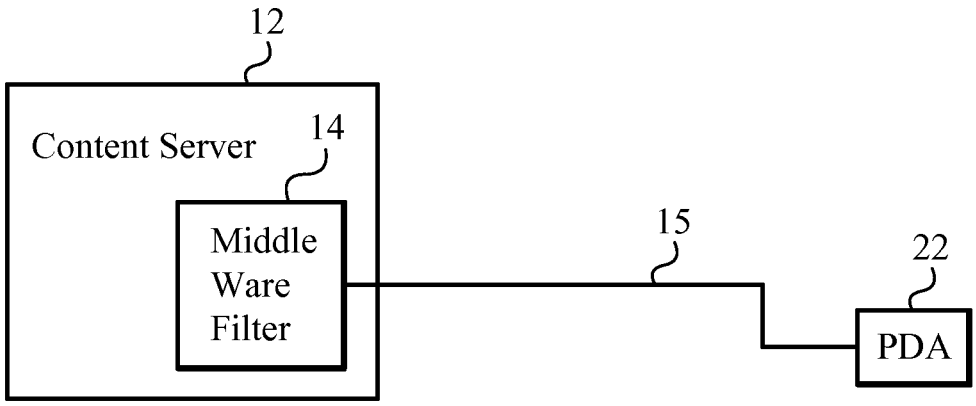

Display
112
To Content Server 10
To PDA 22
126
Video Amp
PHY
142
120
124
Video Mux and Shifters
Network Interface
128
CPU
Video Memory
32
130
122
Main Memory
134
Modem
136
Mass Storage
132
PSTN
Keyboard
Mouse
138
140

Fig. 4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Content Server
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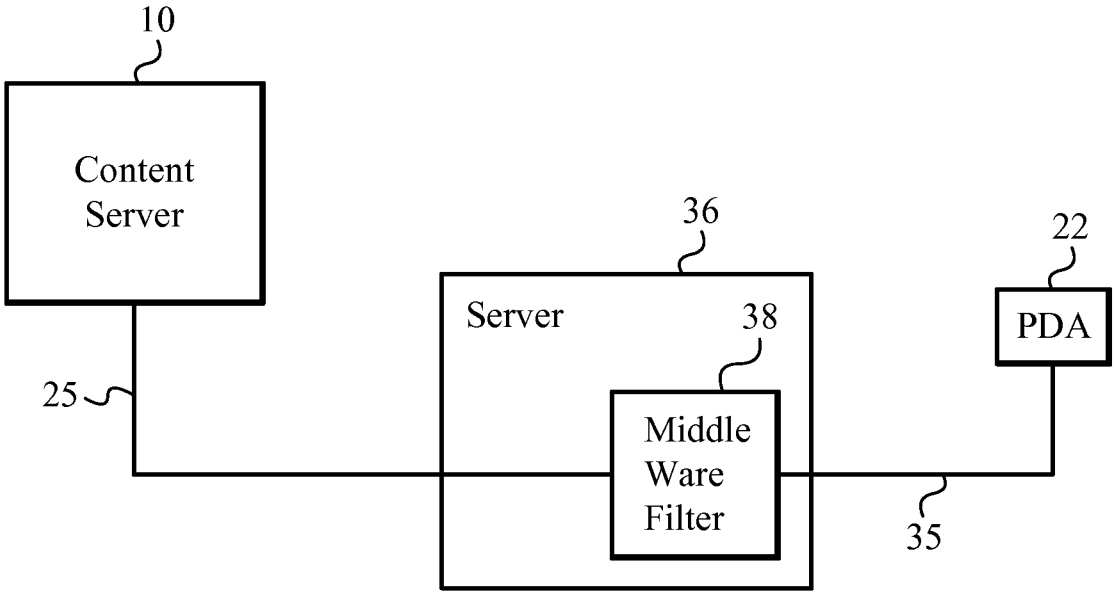
Middle
Ware
Filter
15
22
PDA

Fig. 5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Content
Server
36
Server
38
Middle
Ware
Filter
22
PDA
25
35

Fig. 7

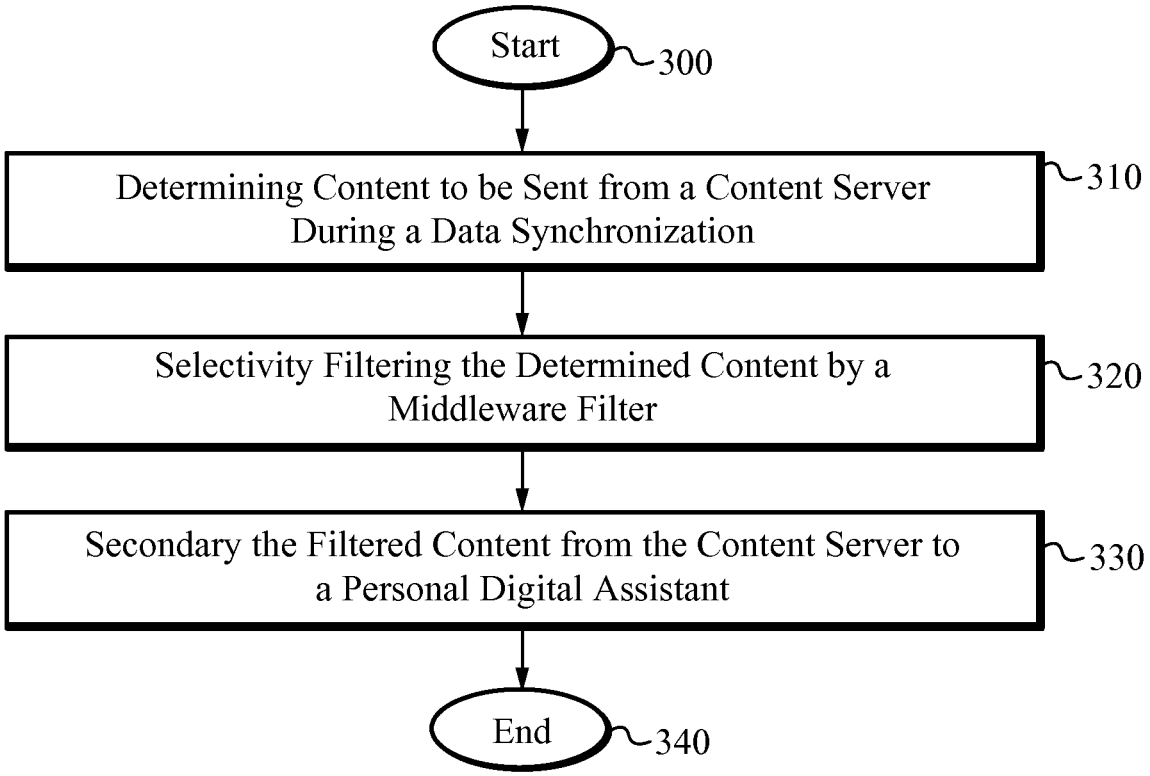
Start
300
Determining Content to be Sent from a Content Server During a Data Synchronization
310
Selectivity Filtering the Determined Content by a Middleware Filter
320
Secondary the Filtered Content from the Content Server to a Personal Digital Assistant
330
End
340

Fig. 6

MIDDLEWARE FILTER AGENT BETWEEN SERVER AND PDA

RELATED APPLICATIONS

This application is a continuation of co-pending U.S. patent application Ser. No. 13/044,302, filed on Mar. 9, 2011, titled "MIDDLEWARE FILTER AGENT BETWEEN SERVER AND PDA", now issued as U.S. Pat. No. 8,359,406, which is a continuation of U.S. patent application Ser. No. 10/666,402, filed on Sep. 17, 2003, titled, "MIDDLEWARE FILTER AGENT BETWEEN SERVER AND PDA", now issued as U.S. Pat. No. 7,925,790. The U.S. patent application Ser. No. 13/044,302, filed on Mar. 9, 2011, titled "MIDDLEWARE FILTER AGENT BETWEEN SERVER AND PDA" and the U.S. patent application Ser. No. 10/666,402, filed on Sep. 17, 2003, titled, "MIDDLEWARE FILTER AGENT BETWEEN SERVER AND PDA" are also hereby incorporated by reference.

FIELD OF THE INVENTION

The present invention relates to the field of synchronizing data between devices. More particularly, the present invention relates to the field of providing a middleware filter agent to filter content sent between a content server and a network device.

BACKGROUND OF THE INVENTION

Communications among web servers, desktop personal computers (PCs), and handheld devices, such as personal digital assistants (PDAs) continues to proliferate. Users desire to share data content among all such devices. Currently, users can download data content from a web server to their PCs and PDAs through an established network connection. When a user synchronizes data between a PDA and a web server, typically a connection is established between the PDA, a cradle for the PDA, the PC connected to the cradle, and the web server coupled to the PC. The order of these connections, and the means by which the data is exchanged during data synchronization are determined by the specific application. However, with most conventional applications, the user is seldom provided with many details related to the data synchronization and the data transferred. Typically, some form of general information is displayed on the PC to inform the user, such as the number of files downloaded. In this case, the PC merely acts as a data transport tool between the web server and the PDA.

Further, PCs and PDAs include different device specifications. For example, the PC includes more memory and greater processing power than the PDA, yet the PDA is easier to carry and more convenient. Due to these different characteristics, some content data types are more suitable for the PC rather than the PDA, while other content data types are more suitable for the PDA.

SUMMARY OF THE INVENTION

In a preferred embodiment, a content server provides content to a first network device. During data synchronization between the content server and the first network device, content is sent from the content server to the first network device via a second network device. The second network device is coupled in between the content server and the first network device. The second network device includes a middleware filter to selectively filter the content provided from the content server to the first network device. The middleware filter includes information related to the first network device, such as device specifications. The content sent by the content server includes meta data that defines content-related information, such as attribute-value pairs associated with the content. The meta data is preferably added to the content by the content server. The second network device receives the content sent from the content server. The middleware filter reads the meta data of the content received by the second network device, and applies rules to the read meta data and the stored information related to the first network device to determine if the content is to be forwarded to the first network device. If the middleware filter determines that the content should be forwarded, then the content is sent to the first network device. Otherwise, the content remains on the second network device and is not forwarded to the first network device.

In one aspect of the present invention, a network of devices to filter synchronized data includes a content server to store content, a first network device, and a middleware filter coupled to the first network device and to the content server such that during a data synchronization, content is received by the middleware filter from the content server according to the data synchronization and the middleware filter selectively sends the received content to the first network device. The content sent by the content server can include meta data. The meta data can include a data type of the content. The middleware filter reads the meta data of the content received from the content server and sends the content to the first network device if the data type of the read meta data matches an authorized data type associated with the first network device. The middleware filter stores the authorized data type of the first network device. The meta data can include an authorized network device type. The middleware filter reads the meta data of the content received from the content server and sends the content to the first network device if the authorized network device type of the read meta data matches a network device type associated with the first network device. The middleware filter stores the network device type of the first network device. The meta data can be added to the content by the content server. The meta data can include data synchronization information corresponding to the data synchronization. The network of devices can also include a display coupled to the middleware filter to display the data synchronization information. The data synchronization can be a one-way data synchronization. The data synchronization can be a bi-directional data synchronization. The second network device can comprise a personal computer. The first network device can comprise a personal digital assistant. The content server can comprise a web server. The second network device can comprise a server. The network of devices can also include a second network device coupled in between the content server and the first network device, wherein the second network device includes the middleware filter. The content server can include the middleware filter.

In another aspect of the present invention, a network of devices to filter synchronized data includes a content server to store content, a personal digital assistant, and a personal computer coupled to the personal digital assistant and to the content server, wherein the personal computer includes a middleware filter such that during a data synchronization, content received by the personal computer from the content server according to the data synchronization is selectively sent to the personal digital assistant by the personal computer according to the middleware filter. The content sent by the content server can include meta data. The meta data can include a data type of the content. The personal computer reads the meta data of the content received from the content

server and sends the content to the personal digital assistant if the data type of the read meta data matches an authorized data type associated with the personal digital assistant. The personal computer stores the authorized data type of the personal digital assistant. The meta data can include an authorized network device type. The personal computer reads the meta data of the content received from the content server and sends the content to the personal digital assistant if the authorized network device type of the read meta data matches a network device type associated with the personal digital assistant. The personal computer stores the network device type of the personal digital assistant. The meta data can be added to the content by the content server. The meta data can include data synchronization information corresponding to the data synchronization. The personal computer can display the data synchronization information. The data synchronization can be a one-way data synchronization. The data synchronization can be a bi-directional data synchronization. The content server can comprise a web server.

In yet another aspect of the present invention, a method of filtering synchronized data includes determining content to be sent from a content server to a first network device during a data synchronization, sending the content from the content server to a second network device coupled between the content server and the first network device, wherein the second network device includes a middleware filter, selectively filtering the content according to the middleware filter, and sending the filtered content from the second network device to the first network device. The content sent from the content server can include meta data. The meta data can include a data type of the content. Selectively filtering the content can include reading the meta data of the content received from the content server by the middleware filter, matching the data type of the read meta data to an authorized data type associated with the first network device, and sending the content to the first network device if the data type of the read meta data matches the authorized data type associated with the first network device. The middleware filter stores the authorized data type of the first network device. The meta data can include an authorized network device type. Selectively filtering the content can include reading the meta data of the content received from the content server by the middleware filter, matching the authorized network device type of the read meta data to a network device type associated with the first network device, and sending the content to the first network device if the authorized network device type of the read meta data matches the network device type associated with the first network device. The middleware filter stores the network device type of the first network device. The meta data can be added to the content by the content server. The meta data can include data synchronization information corresponding to the data synchronization. The method cam also include displaying the data synchronization information. The data synchronization can be a one-way data synchronization. The data synchronization can be a bi-directional data synchronization. The second network device can comprise a personal computer. The first network device can comprise a personal digital assistant. The content server can comprise a web server. The second network device can comprise a server.

In still yet another aspect of the present invention, a method of filtering synchronized data includes determining content to be sent from a content server to a first network device during a data synchronization, wherein the first network device includes a middleware filter, selectively filtering the determined content according to the middleware filter, and sending the filtered content from the content server to the first network device. The content sent from the content server can include meta data. The meta data can include a data type of the content. Selectively filtering the determined content can include reading the meta data of the determined content by the middleware filter, matching the data type of the read meta data to an authorized data type associated with the first network device, and sending the determined content to the first network device if the data type of the read meta data matches the authorized data type associated with the first network device. The middleware filter stores the authorized data type of the first network device. The meta data can include an authorized network device type. Selectively filtering the determined content can include reading the meta data of the determined content by the middleware filter, matching the authorized network device type of the read meta data to a network device type associated with the first network device, and sending the determined content to the first network device if the authorized network device type of the read meta data matches the network device type associated with the first network device. The middleware filter stores the network device type of the first network device. The meta data can be added to the content by the content server. The meta data can include data synchronization information corresponding to the data synchronization. The method can also include displaying the data synchronization information. The data synchronization can be a one-way data synchronization. The data synchronization can be a bi-directional data synchronization. The first network device can comprise a personal digital assistant. The content server can comprise a web server. In another aspect of the present invention, an apparatus to filter synchronized data includes a middleware filter such that during a data synchronization, content is received by the apparatus from a content server according to the data synchronization, and the received content is selectively sent to a network device by the apparatus according to the middleware filter. The content sent by the content server can include meta data. The meta data can include a data type of the content. The middleware filter reads the meta data of the content received from the content server and sends the content to the network device if the data type of the read meta data matches an authorized data type associated with the network device. The middleware filter stores the authorized data type of the network device. The meta data can include an authorized network device type. The middleware filter reads the meta data of the content received from the content server and sends the content to the network device if the authorized network device type of the read meta data matches a network device type associated with the network device. The middleware filter stores the network device type of the network device. The meta data can be added to the content by the content server. The meta data can include data synchronization information corresponding to the data synchronization. The apparatus can also include a display to display the data synchronization information. The data synchronization can be a one-way data synchronization. The data synchronization can be a bi-directional data synchronization. The apparatus can comprise a personal computer. The network device can comprise a personal digital assistant. The content server can comprise a web server. The apparatus can comprise a server.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates an exemplary network of devices.

FIG. **2** illustrates a first and preferred embodiment of the network of devices implementing the middleware filter according to the present invention.

FIG. **3** illustrates a preferred method of filtering synchronized data.

FIG. **4** illustrates an exemplary block diagram of the internal components of the personal computer implementing the middleware filter illustrated in FIG. **2**.

FIG. **5** illustrates a second embodiment of the network of devices implementing the middleware filter according to the present invention.

FIG. **6** illustrates an alternative method of filtering synchronized data.

FIG. **7** illustrates a third embodiment of the network of devices implementing the middleware filter according to the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Embodiments of the present invention include a content server, a middleware filter and a first network device. The content server provides content to the first network device during a data synchronization between the two devices. The middleware filter selectively filters the content provided by the content server such that selected content is provided to the first network device. The middleware filter is preferably included within a second network device coupled between the content server and the first network device. In this manner, the second network device acts as a proxy for the first network device to receive the content provided by the content server. The content is preferably provided from the content server according to a subscription service between the content server and the first network device. The first network device is preferably a personal digital assistant (PDA) and the second network device is preferably a personal computer. The term "content" as used herein preferably refers to data of any data type, including but not limited to audio, video, graphics, text, and any combination thereof. In an alternative embodiment, the content server is coupled to the first network device, without the second network device coupled in between. The middleware filter is included within the content server, and the content is selectively provided from the middleware filter, on the content server, to the first network device.

In the preferred embodiment of the present invention, content provided by the content server includes meta data that describes attributes of the content, such as the size of the content file and the data type. Attributes can also include information related to an end-user network device on which the content is to be used. The middleware filter preferably stores attributes, or specifications, of the network devices, such as the first network device, to which content received from the content server is to be sent during a data synchronization. The middleware filter uses the meta data of the received content and the attributes of the first network device to selectively filter the content before the content is provided to the first network device. Selective filtering is preferably performed according to rules defined within the middleware filter.

FIG. **1** illustrates an exemplary network of devices including a content server **10**, a first network device **20**, and a second network device **30**. The first network device **20** is coupled to the content server **10** via the network connection **15**. The first network device **20** is coupled to the second network device **30** via the network connection **35**. The content server **10** is coupled to the second network device **30** via the network connection **25**. Network connections **15**, **25**, and **35** can be of any conventional type including wired or wireless network connections. The content server **10** includes content which is to be provided to coupled network devices, including the first network device **20** and the second network device **30**. The content is preferably provided as part of a subscription service, where the service is entered into as a service agreement between the content server **10** and a user. As part of the service, content is provided by the content server **10** to a network device during a data synchronization between the content server **10** and the network device.

The present invention includes a middleware filter that selectively filters the content provided by the content server **10**. FIG. **2** illustrates a first and preferred embodiment of the network of devices implementing the middleware filter according to the present invention. Within the drawings, the same elements as to FIGS. **1-7** are labeled with the same numbers. In the preferred embodiment, the middleware filter resides on a proxy network device, where the proxy network device acts as a proxy for an end-user network device. The content is provided by the content server **10** to the proxy network device, where the middleware filter selectively filters the content ultimately destined for the end-user network device. In FIG. **2**, a personal computer (PC) **32** performs as the proxy network device, and a personal digital assistant (PDA) **22** performs as the end-user network device. A middleware filter **34** resides within the PC **32**. Content from the content server **10** is preferably sent over network connection **25** during a data synchronization process. The proxy network device, the PC **32**, preferably manages the subscription service with the content server **10** and any necessary set-up for data transfer. Set-up includes establishing a data channel over the network connection **25**. The specifications of the data channel may vary depending on the type of content sent. For example, where the content is a movie or a game, a movie channel or a game channel is established. Specific channels may correspond to specific output ports on the content server **10**, or other various characteristics, as necessary.

Content provided by the content server **10** is preferably organized using XML. XML is a document mark-up language used for defining structured information. Meta data associated with the content is provided using tags that include attribute-value pairs. The meta data includes content-specific information such as content file size, content data type, content compatible devices, attributes of the content, and the like. Exemplary tags including meta data attribute-value pairs can take the form of:

```
<content>
  <name> spiderman </name>
  <length> long </length>
  <device> PC </device>
</content>
```

The actual organization and arrangement of the meta data is application driven. The meta data can also include messages to be displayed to a user during data synchronization. Preferably, the display messages are displayed on the PC **32**. Alternatively, the display messages are displayed on the PDA **22**. The display messages preferably provide information related to the data synchronization, such as the data type of the content and any other attributes of the content.

Data synchronization is preferably established between the PDA **22** and the content server **10**. Content to be synchronized is determined, and the determined content is sent from the content server **10** to the PC **32**. The middleware filter **34** within the PC **32** receives the content and reads the meta data. The middleware filter **34** also includes device-specific information related to the PDA **22**. Using the read meta data from the received content, and the PDA **22** information, the middleware filter **34** applies rules to determine if the content is to be sent from the PC **32** to the PDA **22**. An exemplary rule

compares the data type of the content to the data types that the PDA is capable of running, or is authorized to run. If the PDA **22** is capable, or authorized, to run the data type of the content then the content is sent from the PC **32** to the PDA **22**. If the data type is not capable, or not authorized, to run on the PDA **22** then the content is not sent to the PDA **22**. Another exemplary rule compares a device type of the PDA **22** with the device types the content is capable, or authorized to run on, as indicated in the meta data of the content. If there is a match, the content is sent to the PDA **22**. If there is not a match, then the content is not sent to the PDA **22**. In this manner, the content received by the PC **32** is selectively filtered by the middleware filter **34**, such that only select content received by the PC **32** is sent to the PDA **22**.

Data synchronization can also be performed where the content is first sent from the content server **10** the PC **32**, and then second, at a later time, the PDA **22** synchronizes with the PC **32** and the filtered content is sent to the PDA **22** from the PC **32**.

This preferred method of synchronizing data is particularly advantageous when the end-user network device, such as the PDA **22**, does not know the data type of the content being sent from the content server **10**.

FIG. **3** illustrates a preferred method of filtering synchronized data. The preferred method relates to the preferred network of devices illustrated in FIG. **2**. The preferred method starts at the step **200**. At the step **210**, content to be sent during a data synchronization between the content server **10** and the PDA **22** is determined. At the step **220**, the determined content is sent from the content server **10** to the PC **32**. At the step **230**, the middleware filter **34** within the PC **32** selectively filters the content received by the PC **32** at the step **220**. At the step **240**, the filtered content is sent from the personal computer **32** to the PDA **22**. The preferred method ends at the step **250**.

An exemplary block diagram of the internal components of the personal computer (PC) **32** is illustrated in FIG. **4**. The PC **32** includes a central processor unit (CPU) **120**, a main memory **130**, a video memory **122**, a mass storage device **132**, a modem **136**, and a network interface circuit **128**, all coupled together by a conventional bi-directional system bus **134**. The interface circuit **128** includes a physical interface circuit **142** for sending and receiving communications over the network connection. The physical interface circuit **142** is coupled to the content server **10** and the PDA **22**. In the preferred embodiment of the present invention, the interface circuit **128** is implemented on a network interface card within the PC **32**. However, it should be apparent to those skilled in the art that the interface circuit **128** can be implemented within the PC **32** in any other appropriate manner, including building the interface circuit onto the motherboard itself. It should also be apparent to those skilled in the art that more or less network connections can be provided by the interface circuit **128** than the two network connections illustrated in FIG. **3**. The interface circuit **128** provides a preferred high-speed connection to the Internet, intranet, or other dedicated network. The network interface circuit **128** also provides an interface for the PC **32** to perform data synchronization. Alternatively, the modem **136** provides a dial-up connection via the public switched telephone network (PSTN) to access the Internet. The mass storage device **132** may include both fixed and removable media using any one or more of magnetic, optical or magneto-optical storage technology or any other available mass storage technology. The system bus **134** contains an address bus for addressing any portion of the memory **122** and **130**. The system bus **134** also includes a data bus for transferring data between and among the CPU **120**, the main memory **130**, the video memory **122**, the mass storage device **132**, the modem **136**, and the interface circuit **128**.

The PC **32** is also coupled to a number of peripheral input and output devices including the keyboard **138**, the mouse **140** and the associated display **112**. The keyboard **138** is coupled to the CPU **120** for allowing a user to input data and control commands into the PC **32**. A conventional mouse **140** is coupled to the keyboard **138** for manipulating graphic images on the display **112** as a cursor control device.

A port of the video memory **122** is coupled to a video multiplex and shifter circuit **124**, which in turn is coupled to a video amplifier **126**. The video amplifier **126** drives the display **112**. The video multiplex and shifter circuitry **124** and the video amplifier **126** convert pixel data stored in the video memory **122** to raster signals suitable for use by the display **112**.

The middleware filter of the present invention is preferably implemented as software, which utilizes the memory and processing capabilities of the network device on which it is installed. In the preferred embodiment, the middleware filter is installed on the personal computer **32**.

FIG. **5** illustrates a second embodiment of the network of devices implementing the middleware filter according to the present invention. In the second embodiment, the PDA **22** is coupled to a content server **12** via the network connection **15**. The content server **12** is the same as the content server **10** with the addition of a middleware filter **14**. The middleware filter **14** operates in a manner similar to that of the middleware filter **34** described in relation to FIG. **2**. In the second embodiment illustrated in FIG. **5**, the content server **12** manages the subscription service with the PDA **22** and any necessary set-up for data transfer.

In the second embodiment, data synchronization is preferably established between the PDA **22** and the content server **12**. Content to be synchronized is determined. The meta data of the determined content is read by the middleware filter **14**. Using the read meta data from the determined content, and the stored PDA **22** information, the middleware filter **14** applies rules to determine if the content is to be sent from the content server **12** to the PDA **22**. In this manner, the content to be synchronized between the content server **12** and the PDA **22** is selectively filtered by the middleware filter **14**, such that the PDA **22** only receives select content.

FIG. **6** illustrates an alternative method of filtering synchronized data. The alternative method relates to the alternate network of devices illustrated in FIG. **5**. The alternative method starts at the step **300**. At the step **310**, content to be sent during a data synchronization between the content server **12** and the PDA **22** is determined. At the step **320**, the middleware filter **14** within the content server **12** selectively filters the content determined at the step **310**. At the step **330**, the filtered content is sent from the content server **12** to the PDA **22**. The alternative method ends at the step **340**.

FIG. **7** illustrates a third embodiment of the network of devices implementing the middleware filter according to the present invention. In the third embodiment, the PC **32** of FIG. **2** is replaced by another server **36**. In this case, the server **36** performs as a distribution point for the content stored in the content server **10**. The server **36** includes a middleware filter **38**. The selective filtering of content transferred during a data synchronization between the content server **10** and the PDA **22**, is similar to that described in relation to the first embodiment illustrated in FIG. **2**.

In operation, a content server provides content to a first network device. During data synchronization between the content server and the first network device, content to be synchronized is sent from the content server to the first net-

work device via a second network device. The second network device is coupled in between the content server and the first network device. The second network device includes a middleware filter to selectively filter the content provided from the content server to the first network device. The middleware filter includes information related to the first network device, such as device specifications. The content includes meta data that defines content-related information, such as attribute-value pairs associated with the content. The meta data is preferably added to the content by the content server. The second network device receives the content sent from the content server. The middleware filter reads the meta data of the content received by the second network device, and applies rules to the read meta data and the stored information related to the first network device to determine if the content is to be forwarded to the first network device. If the middleware filter determines that the content should be forwarded, then the content is sent to the first network device. Otherwise, the content remains on the second network device and is not forwarded to the first network device.

The present invention has been described in terms of specific embodiments incorporating details to facilitate the understanding of the principles of construction and operation of the invention. Such references, herein, to specific embodiments and details thereof are not intended to limit the scope of the claims appended hereto. It will be apparent to those skilled in the art that modifications can be made in the embodiments chosen for illustration without departing from the spirit and scope of the invention. Specifically, although the aforementioned embodiments of the present invention have been described in relation to a one-way data synchronization from the content server to the first network device, data synchronization can also be bi-directional.

What is claimed is:

1. A network of devices to filter synchronized data, the network of devices comprising:

a. a content server to store content;

b. a first network device; and

c. a middleware filter coupled to the first network device and to the content server such that during a data synchronization, the content is received by the middleware filter from the content server according to the data synchronization, and the middleware filter is programmed to selectively filter the content resulting in filtered content and send only the filtered content to the first network device, wherein the middleware filter selectively filters in response to meta data within the content and one or more attributes of the first network device, wherein the meta data comprises a data type of the content, wherein the middleware filter performs an authorization before sending the content to the first network device.

2. The network of devices of claim **1** wherein the middleware filter reads the meta data of the content received from the content server and sends the content to the first network device if the data type of the read meta data matches an authorized data type associated with the first network device.

3. The network of devices of claim **2** wherein the middleware filter stores the authorized data type of the first network device.

4. The network of devices of claim **1** wherein the meta data includes an authorized network device type.

5. The network of devices of claim **4** wherein the middleware filter reads the meta data of the content received from the content server and sends the content to the first network device if the authorized network device type of the read meta data matches a network device type associated with the first network device.

6. The network of devices of claim **5** wherein the middleware filter stores the network device type of the first network device.

7. The network of devices of claim **1** wherein the meta data is added to the content by the content server.

8. The network of devices of claim **1** wherein the meta data includes data synchronization information corresponding to the data synchronization.

9. The network of devices of claim **8** further comprising a display coupled to the middleware filter to display the data synchronization information.

10. The network of devices of claim **1** wherein the data synchronization is a one-way data synchronization.

11. The network of devices of claim **1** wherein the data synchronization is a bi-directional data synchronization.

12. The network of devices of claim **1** wherein the middleware filter is within a second network device and further wherein the second network device comprises a personal computer.

13. The network of devices of claim **1** wherein the first network device comprises a personal digital assistant.

14. The network of devices of claim **1** wherein the content server comprises a web server.

15. The network of devices of claim **1** wherein the middleware filter is within a second network device and further wherein the second network device comprises a server.

16. The network of devices of claim **1** further comprising a second network device coupled in between the content server and the first network device, wherein the second network device includes the middleware filter.

17. The network of devices of claim **1** wherein the content server includes the middleware filter.

18. A network of devices to filter synchronized data, the network of devices comprising:

a. a content server to store content;

b. handheld device; and

c. a personal computer coupled to the handheld device and to the content server, wherein the personal computer includes a middleware filter programmed such that during a data synchronization, content received by the personal computer from the content server according to the data synchronization is selectively filtered according to the middleware filter, resulting in filtered content, wherein only the filtered content is sent to the handheld device by the personal computer, wherein the middleware filter selectively filters in response to meta data within the content and one or more attributes of the handheld device, wherein the meta data comprises a data type of the content, wherein the middleware filter performs an authorization before sending the content to the handheld device.

19. A content server comprising:

a. a memory for storing content and an application, the application configured for providing the content to a device through an intermediary device coupled to the content server, the intermediary device comprising a middleware filter, wherein the content is selectively filtered in response to meta data within the content and one or more attributes of the device, wherein only the filtered content is sent to the device, wherein the meta data comprises a data type of the content and further wherein the middleware filter performs an authorization before sending the content to the device; and

b. a processor for processing the application.

20. An intermediary device comprising:

a. a communication module configured for communicating with an end user device and a content server; and

b. a memory for storing a middleware filter such that during a data synchronization, content received from the content server according to the data synchronization is selectively filtered according to the middleware filter, resulting in filtered content, wherein only the filtered content is sent to the end user device by the intermediary device, wherein the middleware filter selectively filters in response to meta data within the content and one or more attributes of the end user device, wherein the meta data comprises a data type of the content, wherein the middleware filter performs an authorization before sending the content to the end user device.

21. An end user device comprising:

a. a memory for receiving content, wherein the content is selectively filtered in response to meta data within the content and one or more physical attributes of the end user device, wherein the meta data comprises a data type of the content, wherein the memory is further for storing a filter such that during a data synchronization, content received from a content server according to the data synchronization is selectively filtered according to the filter, resulting in filtered content, wherein the filter selectively filters in response to the meta data within the content and the one or more physical attributes of the end user device; and

b. an output mechanism for presenting the filtered content, wherein an authorization is performed before sending the content to the end user device.

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